COURT STREET BRIDGE
(State Bridge No. 959)
Court Street spanning the Blackstone River
and Truman Drive
Woonsocket
Providence County
Rhode Island

HAER NO. RI-45

HAER
RI,
4-WOON,
7-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

HAER
RI,
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7-

**HISTORIC AMERICAN ENGINEERING RECORD**
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<u>Location:</u> Court Street
Spanning the Blackstone River and Truman Drive
Woonsocket, Providence County, Rhode Island

UTM: 19.291960.4652880
USGS Quadrangle: Blackstone, MA 1:24000

<u>Date of Construction:</u> 1894-1895

<u>Designer:</u> Arthur Sweet, Woonsocket City Engineer

<u>Present Owner:</u> City of Woonsocket
169 Main Street
Woonsocket, Rhode Island 02895

<u>Present use:</u> Vehicular and pedestrian bridge

<u>Significance:</u> The Court Street Bridge is a rare example of a late 19th century steel deck truss. The bridge embodies the following distinctive characteristics of the period: Pratt design, fabrication by an independent bridge building company, and pinned connections. It is also an example of material innovation, employing steel, concrete and natural asphalt at an early period in their use.

This structure, the city's first major engineering project, was built by the newly-established City of Woonsocket at a time of great civic and industrial growth. It was determined eligible for listing in the National Register of Historic Places on January 10, 1989 and is an inventoried, contributing resource of the Blackstone River Valley National Heritage Corridor (BRVNHC).

<u>Project Information:</u> The Court Street Bridge is structurally deficient due to age and corrosion of the superstructure. It has been determined that replacement of this superstructure would be an adverse effect. To this end, a Memorandum of Agreement (MOA) was ratified by the RISHPO, BVNHC Commission, FHWA and the Advisory Council on Historic Preservation on Jan. 25, 1996. The MOA includes a stipulation requiring HABS/HAER documentation. This report was prepared to satisfy that stipulation.

Edward Connors and Associates
29 Allen Avenue
Barrington, RI 02806

## HISTORICAL BACKGROUND

### The Crossing

The Blackstone River flows through the City of Woonsocket in the general pattern of a rounded *W*. To the east of downtown the river flows generally northward, after which it turns and continues its southerly path to the Seekonk River and Narragansett Bay. The Court Street Bridge is situated in Woonsocket along the location of this northerly flow.

Because of the intimate connection between the River and the City of Woonsocket, there have been many crossings of the Blackstone. The earliest known crossing, in the vicinity of Woonsocket Falls, dates to the early 18th century. The Court Street Bridge is one of twelve current rail and highway bridges over the river at Woonsocket. This bridge was originally called the Hamlet Avenue Bridge--the nearby crossing it was intended to replace. The earlier crossing, however, was not demolished until ca 1903. The city renamed the new span the Court Street Bridge after the erection of the Woonsocket Court House in 1896.[1] Among the new road alignments created in the construction of the bridge was a street extending from the front entrance of the Courthouse directly onto the east approach. This new street was named Court Street.

The first crossing of the Blackstone in the general location of the Court Street Bridge was--and remains--the bridge built by the Providence & Worcester Railroad ca 1864.[2] At the time of the construction of the first Hamlet Avenue Bridge in 1868, the Blackstone formed the boundary between the Town of Cumberland and the newly-constituted Town of Woonsocket. The bridge, built by private and public subscription,[3] carried Hamlet Avenue over the river to its former intersection with Clinton Street. The exact location of this earlier bridge was a matter of some concern to local interests. It appears that the final location and quality of its timber construction pleased few of its users. A newspaper account of the bridge written a few months after its construction is mixed in its assessment of benefits and liabilities:

> The supporting lumber is hard southern pine, mortised into heavy mud-sills and very securely braced. The workmanship is the very best, and good judges say it is the strongest bridge on the Blackstone. Its cost will be about $10,000. It is not as wide as it might have been, and, worse still, the entrance on the west side is very bad for carriage travel. If horses do not get frightened by the passing trains, it will not be on account of distance from the railroad, nor of the novelty of having a screaming locomotive flying over

their heads.[4]

Almost thirty years later, a less evenhanded account described

> ...its ill-chosen site, crowded against and beneath the Providence & Worcester railroad; it was horseshoe shaped; it had a sixteen-feet driveway, and one seven-feet walk. Trains thundered overhead scaring horses. The boarded truss between shut out all view of the driveway from the walk. Trains thundered overhead, scaring horses. It rested on wooded posts standing on stones dumped into the mud in the river.[5]

A more technical--and decidedly less poetic--description is provided by the Woonsocket City Engineer's Report for 1895:

> The Bridge over the Blackstone River is of wood, four spans, 156 feet long, width of roadway 17.4 feet, one sidewalk 6.7 feet wide. The timbers in this bridge are too tight and placed too far apart for the work required of them and should be reinforced by addition of larger timbers.[6]

Woonsocket was incorporated as a city in 1888. From the city's very beginning, the condition of the Hamlet Avenue Bridge and often-conflicting plans for its replacement dominated local politics. There was good reason for this conflict--Woonsocket was in a period of tremendous civic and industrial growth, much of that growth located in the immediate vicinity of the bridge.

One industrial site much affected by the location of the proposed bridge was the Eagle Mill complex located on the west bank of the river to the north of the present bridge. This mill drew water from the Blackstone by way of Clinton pond, named for the Clinton Mills located downstream. As described in the *Evening Reporter,* the interest of the Eagle Mills was, simply put, "to be let alone." The owners set about gathering support for a bridge "carried across, under, over or through the railroad to a point on Clinton Street north of the railroad."[7] The Eagle proprietors also owned commercial property on Main Street to the south of the mill which they sub-leased and rented. Because the City Council was prepared to exercise eminent domain with regard to affected properties, these tenants and lessees supported the Eagle interests. To this body of support was added those who wanted the simplest and least expensive solution: a bridge in the same location. Not the least among these supporters were the owners of the *Evening Reporter,* one of the two major daily newspapers serving the city.

The possibility of substantial loss or great profit for interested parties spurred influential citizens to forge political alliances to rally support for the opposing bridge plans.[8] From the early months of 1890 to the summer of 1893, the city found itself embroiled in the politics of two rival bridge plans. Although modified over the course of the three years, the rival plans were: *Plan A,* the general location of the current bridge; and *Plan C,* a new bridge--wider and better aligned--in the general location of the original Hamlet Avenue Bridge.

After much political wrangling, voter petitioning, and conflicting assessments of costs and damages, the issue was put to a popular vote in May 1893. The results showed overwhelming support for Plan A--a new bridge upstream.[9] Less than a month later, the City Council ordered the necessary realignment of streets to conform to the bridge's planned approaches. The new Hamlet Avenue Bridge would span the Blackstone River and Clinton Pond[10] just south of the Eagle Mills.

One recommendation in the 1894 inaugural address of Mayor Aram Pothier was the creation of an independent bridge commission. This would remove from the City Council the day-to-day affairs of building a structure of this size. This action was opposed successfully by the Aldermen, six of whom came to be seated on a special commission under the chairmanship of Mayor Pothier.

In April 1894 the city appointed Arthur R. Sweet as the first Woonsocket City Engineer. In this capacity he was entrusted with the engineering of the bridge.[11] In June of that year the City Council appropriated $178,500 for construction.

Shortly after Sweet's appointment he completed general plans and sought construction bids. The twelve proposals submitted varied widely--four companies proposed masonry arch bridges, eight proposed metal trusses. The masonry structures ranged in cost from $274,000 to $805,500 and the metal bridges from $192,000 to $215,000.[12] The successful low bid for a Pratt-type deck truss was submitted by Dean & Westbrook (New York).

While Dean & Westbrook's original estimate exceeded the money allotted by the City of Woonsocket, they offered a cost-cutting alternative: "a lighter paving, either asphalt or vitrified brick, instead of granite, which the specifications called for."[13] With this alternative, Dean & Westbrook could build the bridge for $177,900.

Construction of the new Hamlet Avenue (Court Street) Bridge

The excavation and masonry work for the piers and abutments was subcontracted to John B. Reilly Co. (Trenton, NJ) and carried out according to the following schedule:

| | | |
|---|---|---|
| East abutment: | begun June 13 | completed October 1894 |
| Pier 3: | begun July 1 | completed August 1894 |
| Pier 2: | begun July 20 | completed September 1894 |
| Pier 1: | begun August 7 | completed September 1894 |
| West abutment: | begun August 16 | completed December 1894 |

According to the *Evening Reporter,* the excavation work required the use of "seven 60' mast derricks, hoisting engines, steam and electric pumps, tramway and cars."[14] An average work force numbered around 60 men. At times, however, there were as many as 125 workmen on the site.

While the west abutment itself was given a clean bill of health, a noticeable crack and bulge appeared in the southwest wingwall around April 1895. This occupied the attentions of newly-appointed City Engineer Frank Mills, Dean & Westbrook, and the owner of the abutting property until well after the bridge's official opening. Although there was general agreement among all parties that the wall was inadequate, solutions ranged from a complete replacement to the construction of a buttress or relieving wall. Mired in the legal implications of the various solutions, the Commission voted on June 20 to accept the wingwall regardless of its instability. Engineer Mills was asked to report back to the Commission with a solution and plans. On July 4 Mills presented two options to the Commission: a $700 relieving wall or a more expensive rebuilding of the wingwall. The Commission chose the former.

Dean & Westbrook subcontracted the superstructure of the bridge to the Berlin Iron Bridge Company (East Berlin, CT), one of the original bidders for the whole project. Berlin commenced construction at the east end on December 5, 1894, completing the truss work the following May. The deck and wearing surface, contracted to Everson & Liddle (Providence), was begun on or about June 1 and completed June 18--four days before a grand celebration to mark the official opening of the bridge. The opening was timely; a brief newspaper item of June 20, 1895 observed that the old Hamlet Avenue Bridge was "liable to tumble into the river at any moment."[15] With such an eventuality in mind the city fathers took the precaution of closing both entrances before the festivities.

**The Opening Celebration**

On the evening of June 22, 1895, thousands of Woonsocket's citizens gathered to celebrate the official opening of the new Hamlet Avenue Bridge. This was just two days before the traditional celebration of the Feast of St. John the Baptist, the major ethnic/religious holiday of the area's large and growing

French-Canadian population. The proximity of this opening to the approaching holiday could not have been lost on Aram Pothier, Woonsocket's first French-Canadian mayor. Despite predictions of unsettled weather, the evening was clear. Few details of the festivities were left to chance. Mills and shops dismissed their workers at noon and upriver at the Blackstone Dam flashboards were removed to ensure an adequate flow of water below the bridge.

The celebration began at 6:30 pm with a 13-gun salute fired from the small island in the river at pier 1. Thus began a procession from Depot Square that included 30 horsemen, a platoon of police officers, the Woonsocket Cornet Band, dignitaries, and invited guests.

The focal point of the evening's proceedings was a temporary arch and platform erected across the roadway at the eastern entrance to the bridge. Literary exercises included a keynote speech by Mayor Pothier and a lengthy dedicatory poem by Erastus Richardson, city historian and poet (Supplemental Material). Just before 8:00 pm the Mayor declared the bridge formally opened.

Promptly at eight began an "electrical illumination" described by the *Evening Call* as "the grandest display of dazzling electric lights that has been made in this city, at least since Edison solved the problem of incandescent illumination."[16] The display, conceived by Levi C. Lincoln, manager of the Woonsocket Electric Machine and Power Company, mixed incandescent and arc lighting--both wonders of the age. It was by all accounts the high point of the evening.

The arch was illuminated with 720 red, white, and blue bulbs. These lamps formed stars, an anchor, a shield, and the words, *City of Woonsocket, June 22, 1895*. Above the arch flew the American flag. This illumination was followed by the lighting of a train of about 500 lamps extending the full length of both flanks of the bridge.

With the illumination in full operation, the Woonsocket Cornet and Social Bands entertained until midnight. The *Evening Reporter* issued a four-page "Bridge Dedication Special Edition" that celebrated the role of the Aldermen, the Mayor, and the stunning success of Plan A. The *Providence Journal* noted wryly that the *Reporter* "...modestly forebore mentioning the prominent part it played on the right side in the long, hot bridge fight."[17] Two days later, 1500 of the city's French-Canadians paraded over the new bridge in their observance of St. John's Day. The day's events closed with a re-lighting of the bridge's electrical display from 8:00 to 9:00 pm.

## Significance

### Pratt Truss Bridges

The transportation demands of an expanding nation and, more particularly, the expansion of the American rail and turnpike systems in the 19th century provided a powerful impetus to bridge design and innovation. Where time and money permitted, rail companies built stone masonry bridges to carry their lines over water or land depressions. Though exceptionally durable, construction of these stone bridges demanded a great deal of time. When time or money required, the vast supply of American timber provided a readily available construction material.

These were the circumstances of much of the empirical, rule-of-thumb innovation in early 19th century wooden truss design. By mid-century a distinct professional discipline of bridge engineering began to emerge; patented truss designs were promoted; and structural members of timber, wholly or in part, came to be replaced with wrought iron.

Two truss designs widely employed in 19th century America were the Pratt and Warren designs, both dating to the 1840s. Alan Comp and Donald Jackson, in their 1977 HAER study, *Truss Types,* describe this process of standardization:

> The economic nature of the American construction industry is such that there is a natural tendency for uniformity and standardization. During the last half of the nineteenth century, many different trusses were developed, but, in the ensuing competition, the Pratt and Warren forms gradually demonstrated their versatility, durability and economic desirability to such an extent that by the early twentieth century, almost all bridge trusses were constructed using variations of these forms.[18]

The distinguishing features of the Pratt design (patented in 1844 by Thomas and Caleb Pratt) are vertical compression and diagonal tension members. In the superstructure of the Court Street Bridge the verticals are box girders with latticed sides and the diagonals are stamped eyebars.

### Berlin Iron Bridge Company and the transition from iron to steel

Berlin Iron Bridge Company placed a bid as main contractor for the Court Street Bridge in 1894. Underbid by Dean & Westbrook, Berlin was then hired as a subcontractor to fabricate and erect the steel superstructure of the bridge.

Berlin began its operations ca. 1875 in Berlin, Connecticut as Corrugated Metal Company, a builder of iron roof trusses. Around 1879 the company entered the business of bridge construction, changing its name to Berlin Iron Bridge Company in 1883.[19]

Prior to the Civil War, railroad companies typically designed and produced bridges in their own shops. In the years after the War there emerged, along with the distinct discipline of bridge engineering, independent bridgeworks. These companies, such as Berlin Iron Bridge Company, fabricated all the structural components in their shops and shipped them to the construction site for erection.

Berlin's original works were located at a five-acre site on the west bank of Connecticut's Mattabassett River. To address the great expansion of its business in the 1880s, the company acquired land on the east side of the river ca. 1890, building their new three-acre main building at that location. As opposed to the difficulties posed by the gradual accretion of buildings at the old site, the main feature of the new plant was its unidirectional work flow. Three narrow gauge tracks passed through the building; raw materials delivered to the north end of the shop emerged as completed steel components at the south end. An adjacent line of the New York New Haven & Hartford Railroad provided standard gauge service for the transport of raw and finished materials.[20] Berlin fabricated the superstructure of the Court Street Bridge at this plant.

The mid-century introduction of the Bessemer and open hearth steel making processes brought about a general transition from iron to steel in the last quarter of the 19th century. By the mid-1890s steel was in general use in bridge-building.[21] As part of a broad consolidation of independent bridge companies, Berlin Iron Bridge Company was one of 24 firms absorbed into U.S. Steel's American Bridge Company in 1900.

**The Woonsocket Street Railway**

In 1887, seven years before the construction of the Court Street Bridge, a group of investors established the Woonsocket Street Railway Company, the first electric street railway system in New England and one of the earliest systems in the country. This line originally crossed the old Hamlet Avenue Bridge and was re-routed to the alignment of the present bridge late in 1895.

Concurrent with the rapid innovation in electric motor design and power transmission in the 1880s was a growing public sense that horse-drawn urban transportation was, for many reasons, a blight upon city life. In an article commending the social benefits of electric street railways, Commissioner of Labor Carroll D. Wright wrote in 1892:

> The presence of so many horses constantly moving through the streets is a very serious matter. The vitiation of the air by the presence of so many animals is alone a sufficient reason for their removal, while the clogged condition of the streets impedes business and involves the safety of life and limb.[22]

In the early years of street railways there were several competing systems,[23] differing most significantly in the means of power transmission. Woonsocket's system was of the Bentley-Knight type. Edward Bentley and Walter Knight, two early innovators in street railway engineering, began their work in the offices of the Brush Electric Company in Cleveland in 1883. A year later on the streets of that city they were operating the first public street railway line in the United States.

In 1886, after the Brush Company's abandonment of the Cleveland street railway, Bentley and Knight opened up offices in New York and carried on experimentation at the Rhode Island Locomotive Works in Providence. The following year the company received three contracts for the installation of street railway systems: Fulton Street (New York City), Allegheny City (PA), and Woonsocket (RI). At this time Bentley-Knight switched from Rhode Island Locomotive Works to the Thomson-Houston Company of Connecticut for the manufacture of motors and electrical parts.[24]

By October 1887 the installation was complete and the electrified Woonsocket Street Railway was in operation. The Bentley-Knight system utilized two overhead wires instead of the single-wire Van DePoele system that would soon come to dominate street railway systems in the United States. The Woonsocket system was plagued by a common difficulty of that early period. The motor's internal brushes carrying high-voltage DC current to the commutator were fabricated of copper. Despite the efforts of Bentley-Knight and others to eliminate commutator damage caused by these copper brushes, the problem was not solved until the introduction of carbon brushes in 1888.

The same year Thomson-Houston acquired most of the important patents in the then-largely experimental street railway field and began the process of standardization, a most notable aspect of which was the general acceptance of the single overhead wire trolley system.[25] It appears that by the time of the construction of the Court Street Bridge the Bentley-Knight two-conductor overhead system had been replaced with a Van DePoele system using a single transmission wire--the metal tracks serving as a system ground. This greater physical distance maintained between the two high voltage poles was a clear improvement in safety. It did, however, require that the tracks be well-insulated from the steel buckle plates on the bridge deck.

A contemporary description of the bridge described special efforts to prevent "...the [streetcar's] electric current from entering the bridge metal."[26] In a Bentley-Knight system this would not have been an issue; the wheels and tracks were insulated from the current flow.

This was not the only design accommodation made to streetcar use in the design of the Court Street Bridge: stringers No. 1 and 3 from the south upper chord (immediately below the track location) were doubled in depth to handle the extra weight of the cars.

**Material innovation: concrete and natural asphalt**

Because the original bid request for the Court Street Bridge did not specify a particular type of bridge, proposals for the deck and wearing surface varied widely. One cost-saving aspect of the Dean & Westbrook proposal was innovative in two ways: the roadway would be constructed of six inches of concrete with a two inch wearing surface of "Trinidadian asphalt."

**Concrete.** While concrete construction dates to the Roman period, it fell into disuse in the Middle Ages and was not reintroduced in the modern era until the early 19th century. This material was in general use in Europe by the 1870s. In the United States, its first use in bridge construction was a plain concrete arch in Brooklyn's Prospect Park (1871). As a road construction material, concrete was first used in Bellefontaine, Ohio (1891).

Along with their bid Dean & Westbrook proposed concrete as a substitute for more traditional deck types. The Bridge Commission accepted this proposal--and the subsequent decrease in cost. The deck and flooring work were subcontracted to Everson and Liddle of Providence, the work performed between June 1 and June 18, 1895.

Concrete was also used on bedrock or pilings as a levelling course for the placement of the granite blocks used in the piers and abutments.

**Natural asphalt.** The first known use of natural asphalt as a road surface was in 18th century France. According to a turn-of- the-century account, asphalt chunks fallen from carts "rolled beneath wheels [and were]...compacted into a homogenous and resisting surface."[27] Such empirical observations may have led to its use as a wearing surface. These practical applications and the occurrence of large natural deposits of asphalt attracted the attention of scientists and entrepreneurs throughout much of the 19th century. One of the largest and most accessible deposits was a 114-acre, 100 foot deep, asphalt lake in Trinidad near the Bay of Paria.

Earlier in the century this asphalt was harvested and hand-carted to the nearby beach for transport. In 1893-4 the construction of a wharf and a tramway allowed an expansion of the export process. From Paria, Trinidadian asphalt was shipped to cities all along the eastern seaboard of the United States and as far west as Denver.[28] Everson and Liddle procured their asphalt from this source.[29]

The naturally-occurring asphalt applied to the deck of the Court Street Bridge represents an early--and problematic--use of this material. Sinkholes had appeared in the road surface of span 2 by the time of the bridge's opening. By 1903 the Woonsocket City Engineer was calling for extensive repair of the roadway.

Use of natural asphalt declined rapidly early in the 20th century as coal tar (produced as a gas plant by-product) and asphalt (produced in the fractional distillation of crude oil) became commonly used as macadam binders in road construction.[30] With the dramatic rise in demand for gasoline early in the century, petroleum-based asphalt became widely available.

## Description:

### General:

The Court Street Bridge is a four span, steel, pin-connected, Pratt deck truss of 31 panels. Its overall length is 524 feet. Spans 2, 3, and 4 are 50 feet wide, comprising a 34 foot roadway and two 8 foot sidewalks. These sidewalks are supported by triangular plate girder brackets. At span 1 the bridge widens in a westerly direction to 85 feet at the west abutment. These spans carry Court Street in an east-west direction over Truman Drive (originally Clinton Pond and a smaller perpendicular mill trench) and the Blackstone River. At the time of its construction the bridge carried a live load of 100 lbs./ft$^2$ and a dead load of 170 lbs./ft$^2$. The bridge was built according to Cooper's Specifications of 1891.[31]

The bridge deck stands approximately 60 feet above water level. The entire bridge is on a curvature of 2500 foot radius, the highest point of which, located at the junction of spans 2 and 3, rises 16" above the lowest point.

Pin connections are located at each panel point. These bolts connect the upper chord, the box girder verticals, the eyebar diagonals, and the eyebars (or box girders) of the lower chord. The ironwork weighed 1,788,321 lbs. Some 1000,000 rivets and 40,000 bolts hold the bridge together.

### Substructure:

The piers and abutments are constructed of regularly coursed granite ashlar resting on a 6" levelling course of plain concrete on bedrock. Total masonry used was 4,850 cubic yards. As described in the *Evening Call*, "...if put in one solid mass, [it] would make a pile 52 feet square and 50 feet high."[32]

The **west abutment** stands west of Truman Drive on land that was formerly the west bank of Clinton Pond. It rises 57 feet from a concrete foundation of 22 x 86 feet and is 9 feet wide at the bridge seat. It is 85 feet long. The original wingwalls rested on bedrock, extending 23 feet from the abutment. This abutment required 2400 yards of masonry.

The original southwestern wingwall has been replaced by a curved wall of regularly coursed granite ashlar. The landscaped earth impounded by this wall now provides a stairway from the Main Street approach to Truman Drive below.

**Pier 1** stands east of Truman Drive on land that was once an island separating the Blackstone River from Clinton Pond. After the demolition of the Eagle Mills in 1937, the pond was drained and filled. As part of a Woonsocket urban redevelopment project, Truman Drive was created along the path of the former waterway in 1960. It rises 27 feet from a concrete foundation of 50 x 10 feet and is 6'6" wide under coping. It is 46 feet long.

Pier 2 sits on a small island in the Blackstone River. This location was adjacent to an outlet from Clinton Pond to the river. It rises 35 feet from a concrete foundation of 60 x 11 feet--approximately 19 feet above water, 3 feet in the water, and 13 feet below water to bedrock. It is 46 feet long and 7 feet wide under coping. On the upstream face of this pier there is a prominent granite "nose" serving as an icebreaker.

Pier 3 is on the east bank of the river. It rises 29 feet from a concrete foundation of 50 x 10 feet. It is 46 feet long and 6'6" wide under coping.

The east abutment, with wingwalls, forms the shape of a *U* on a rise approximately 70 feet back from the Blackstone River. It rises 45 feet and rests on a concrete foundation. It is 50 feet long, 10'6" wide at the bridge seat, and 12 feet wide at bedrock. Two wingwalls extend 30 and 35 feet from the abutment.

Superstructure:

The superstructure of the Court Street Bridge was fabricated by the Berlin Iron Bridge Company and erected between early December 1894 and late May of the following year. Because of the complexity of this structure, particularly span 1, certain characteristics of the various spans will be described separately. Due to the considerable dimensional and structural variation of steel members on the four spans of this bridge, a full description would be impossible in this report.

This four span truss bridge is of the Pratt-type, the distinguishing characteristic of which is the use of vertical members in compression and diagonals in tension. This division of labor is clearly visible in the composition of these members: the verticals are box girders with latticed sides[33], the main diagonals are eyebars stamped from 1 7/8" flat steel weighing 1,100 lbs. each. These diagonal eyebars are in pairs. Counter diagonals in the center panel[34] were formed of loop welded steel.

The lower chord at the end panel of each span is a box girder with latticed sides. The remainder of this chord is a succession of double eyebars similar to the diagonals mentioned above. The struts forming the perpendicular connection between the two lower chords are box girders with latticed sides. Steel tension rods with turnbuckles form the lateral bracing between the lower chords as well as the sway bars. The upper chord is a box girder with latticed top and bottom.

Span 4, the easternmost and smallest span, consists of two trusses. The south truss is 78'4" long, consisting of five panels. The north truss is 61 feet long, consisting of four panels. The truss depth is 15 feet. Because of the 9 foot difference in truss depth between this and the adjoining span, a pair of curved plate girder brackets secures the lower chord to the box girder column resting on pier 3.[35]

Span 3 consists of two nine-panel, 160 foot long trusses. The truss depth is 24 feet.

Span 2 consists of two nine-panel, 147 foot long trusses. The truss depth is also 24 feet.

Span 1 consists of four trusses. The three eight-panel, southernmost trusses of this span are 124 feet long and aligned in parallel. The northernmost seven-panel truss is 116 feet long, extending approximately 12 degrees from the parallel alignment of the other trusses. The two southernmost trusses share struts and bracing, as do the two northernmost trusses. At the west abutment and pier 1, box girder struts tie all four trusses together. Elsewhere, there are no struts or bracing connecting the two middle trusses.

Expansion and contraction of the steelwork up to a maximum of 7" is permitted by a roller and plate located at the abutments and on pier 2. These lower mechanisms are matched by expansion joints located at the extreme ends and the middle of the deck. Recent engineering studies indicate that damage to the west abutment can be attributed to inoperation of the west expansion joint.

**Floor system:**

The floorbeams, weighing 2.5 tons each, are plate girders 5 feet in depth connected to the verticals at each panel point. The stringers, tied in to the side of the beams by angled bearing bases, are typically 12" deep and spaced 3 feet apart. On spans 2, 3, and 4 there are 11 stringers. On span 1 there are added stringers of partial span length running at an acute angle to the north truss. From the south side of the bridge, stringers 1 and 3 are approximately 24" in depth. These supported the extra weight of the streetcar tracks that ran along this flank of the bridge.

The original deck was constructed of 1/4" steel buckle plates attached to the stringers. On this surface a 6" layer of concrete was applied.[36] The wearing surface was a 2" application of natural asphalt. Wooden planking was inserted beneath the tracks to aid in insulating the bridge metal from the return current of the streetcar line.

Curb-to-curb, the roadway was 34 feet wide. The 8 foot sidewalks were bracketed, surfaced with granolith, and curbed with steel. It is likely that Berlin Iron Bridge Company procured the decorative "Bridgeport" railing from a subcontractor.[37] The two-tiered outer railing at the far edge of the sidewalk was approximately 48" high, the upper tier fabricated of square and twisted wrought iron joined with a medallion, the lower tier of stamped plate. A smaller, approximately 24" high pipe railing separated the sidewalk from the roadway.

These railings were painted in two shades of green. A July 1895 article in the *Evening Patriot* described a post-celebration Bridge Commission meeting in which a railing along the southwest wingwall was to be painted "bottle green." This may have been one of the two green shades of the Bridgeport railing described in contemporary newspaper accounts. The superstructure was painted with one shopcoat and two fieldcoats of mineral red paint.[38]

### Utilities

Three 30 foot electric light poles were mounted on the north side and five trolley poles on the south side of the bridge. The original utilities carried below the deck were a 20" water main and a 12" gas main. At present there are two gas mains (16" and 12"), a 20" water main and eight 6" telephone conduits.

### Major 20th Century Alterations

Annual bridge inspection reports of the Woonsocket City Engineer indicate that repairs were required within a few years of construction. The following excerpts are drawn from that source:

> 1903 *Bituminous surface of the roadway is in very bad condition and should be entirely resurfaced. Paint on sidewalk railings is flaked badly and should be scraped and repaired.*
>
> 1911 *There has been considerable deterioration of the bottom flanges of that part of the floor beams and the stringers which come under the Woonsocket Street Railway Company's tracks...*

1916 *Anticipated repairs have not been done because bridge companies have been on War Orders*

1917 *W.L. Waples and Co. of Boston was hired to sandblast and paint the Court Street Bridge.*

In a 1938 reconstruction project the original deck (steel buckle plates, concrete, and asphalt) was removed and replaced with an open steel grate. This grate rests on transverse deck joists. A 1995 study prepared by PARE Engineering (Lincoln, RI) describes the result of this renovation:

> ...the major contributor to the deterioration of the Court Street Bridge is the open steel deck grating. Sand, salt, and other debris fall through the grating and deposit on the structural elements below, causing accelerated corrosion. The corrosion of the superstructure elements varies from light rusting to substantial loss of section along flanges and at connections.[39]

In 1960 The City of Woonsocket carried out further repairs on the grating, floor beams, and stringers. At this time, the original pedestrian and curbside railings were replaced by modern pipe railings. The streetcar rails were also removed during this renovation. In 1978 the city repaired a total of 210 feet of deteriorated floor beam. Three years later, the south sidewalk was closed to pedestrian traffic. A temporary walkway was erected in the eastbound roadway at the location of the old streetcar track.

NOTES

1. This building, now empty, recently housed the State Superior, District, and Family Courts. As described in the R.I. Historical Preservation Commission's *Statewide Historic Preservation Report P-W-1* (1976): "Little altered since the nineteenth century, it retains much of its original interior finish and furnishings. Designed by William Walker and conceived as a monumental structure, it is highly successful architecturally--bold and ruggedly handsome, with particularly fine polychrome stonework. The massing is picturesque, and the tower terminates a long vista down Court Street from Depot Square."

2. While several granite piers of the original rail bridge are still in use, the current plate girder superstructure is not original.

3. The Town of Woonsocket appropriated $1500; The Town of Smithfield approximately $1500. Among the private contributors were the Woonsocket Company, the Woonsocket Gas Company, and the Hamlet Company--$1000 each. The Woonsocket Company and the Groton Company (later, the Eagle Mills) both granted land, the latter also providing a right of way over its mill trench. Source: "The Old Bridge." *The Evening Call* (26 June 1895): 4.

4. "Glances About Town." *The Patriot* (4 September 1868): 2

5. "History of the Bridge." *The Evening Reporter,* Special Edition (24 June, 1895): 2

6. *First Annual Report of the City Engineer*. City of Woonsocket: January 1896

7. "History of the Bridge." *The Evening Reporter,* Special Edition (24 June 1895): 2

8. The City of Woonsocket eventually paid $130,000 in land damages to abutting owners.

9. The actual results of the vote were: Plan A, 840; Plan B, 175

10. This pond was named for the Clinton Mills located at a point on the Blackstone downstream from the smaller Eagle Mills. Clinton Pond was part of a network of raceways and storage ponds drawn from the Blackstone at that location. Span 1, now crossing Truman Drive, originally spanned a portion of Clinton Pond that was called the Eagle Trench.

11. Sweet held this position until April 1895, at which time he was retained as Engineer for the Bridge Commission--a post that he held until the ceremonial opening of the bridge on June 22, 1895. He was succeeded as City Engineer by Frank H. Mills.

12. While contemporary accounts are not specific as to the bidder and amount submitted, the following information can be obtained: The companies bidding on a metal bridge were Pennsylvania Bridge Company (Beaver Falls, PA), $214,700; Toledo Bridge Company (Toledo, OH); the Wrought Iron Bridge Company (Canton, OH); Massillon Bridge Company (Kane, PA); Berlin Iron Bridge Company (East Berlin , CT); R.F. Hawkins Ironworks, (Springfield, MA); Groton Bridge Company (Groton, NY); and Dean & Westbrook (NY, New York), ($192,240). The four companies proposing a masonry bridge are not identified.

13. "History of the Bridge." *The Evening Reporter*, Special Edition (24 June 1895): 2

14. ibid

15. Untitled item. *Providence Journal* (20 June 1895): 3

16. "Bridge Celebration." *The Evening Call* (24 June 1895): 4

17. "Woonsocket Ablaze." *The Providence Sunday Journal* (23 June 1895): 7

18. Comp, Alan and Donald Jackson. *Bridge Truss Types, a guide to dating and identifying.* Nashville, TN: American Association for State and Local History, 1977

19. Victor Darnell. *A Directory of American Bridge Building Companies, 1840-1900.* Washington: Society for Industrial Archeology, 1984

20. It is interesting to note that the plant was illuminated by a Thomson-Houston dynamo powering 250 incandescent and 12 arc lamps--this company had also furnished electrical equipment to Bentley-Knight for the Woonsocket Street Railway in 1887.

21. Rhode Island's first steel bridge, the Manton Village Bridge, was built in 1889. Although slated for replacement, it survives with some alteration on Manton Avenue at the Johnston/Providence line.

22. Originally published in *Popular Science Monthly,* Carroll is quoted in Joel Tarr, "Urban Pollution--Many Long Years Ago." *American Heritage* 22 (October 1971): 68

23. In 1888 there were 13 electric railway companies utilizing 5 different electrical systems and 48 total miles of electrified track. Source: Killingworth Hedges. *American Electric Street Railways: Their Construction and Equipment* (New York: Spon and Chamberlain, 1894): 6-7

24. There is some disagreement on this point. Charles Carroll, in a mid-1930s description of the State's transportation system (*Three Centuries of Democracy,* p. 831) states that the original Woonsocket equipment was manufactured at the plant of the Woonsocket Electric Machine and Power Company under the direction of Frank M. Thayer, who also supervised the installation of the overhead wires.

25. By 1890 there were 2,900 streetcars in the US, two thirds of these equipped by Thomson-Houston and Sprague, a competitor.

26. The provision made by the contractors to ensure this insulation was the insertion of wood planking between the trolley rails and the buckle plates. See "The Bridge Described." *The Evening Reporter,* Special Edition (24 June, 1895)

27. For a detailed description of the history and chemistry of asphalt, see S.F. Peckham, "Asphaltum for a Modern Street." *Popular Science Monthly* 58 (January 1901): 228

28. The novelty of this wearing surface is evidenced by the naming of the ca. 1890 Manton Avenue Bridge in the Olneyville section of Providence. City Bridge Engineer reports and original drawings refer to the "Tar Bridge." The bridge was replaced in a road modernization project.

29. The Barbour Asphalt Company had threatened Dean & Westbrook with a patent infringement suit in the use of Trinidadian asphalt on the Court Street Bridge. This was dropped, however, when D&W were made aware that a similar suit was unsuccessful. According to an article in the *Evening Call* (16 April 1895: 4), Barbour Asphalt Company controlled the output of Trinidadian asphalt at the Bay of Paria. See also an *Evening Reporter* Article of the same date and a follow-up article in the 17 April edition of the *Evening Call.*

30. These were not generally applied as binders to macadam roads in Rhode Island until ca. 1906. For a description of the Rhode Island State Board of Public Roads' early experimental work with asphalt and coal tar as road surfaces, see "Our Bituminous Macadam Roads," in the *13th Annual Report of the State Board of Public Roads*

(Providence: E.L. Freeman, 1915) pp. 11-32

31. In the post-Civil War years railway companies often prepared their own construction specifications. Among them were the specifications written by Theodore Cooper for the Erie Railroad in 1879. These were later adopted as general specifications by several bridge building companies. For a more detailed description of rail companies, specifications, and bridge building companies of the era, see Henry Grattan Tyrell, *History of Bridge Engineering* (Chicago, by the author: 1911, p. 178).

32. "New Plan A Bridge." *Evening Call* (20 June 1895): 3

33. The dimensions of these vertical box girders vary with the spans. For example, a large vertical support column located on pier 1 is a box girder approximately 24" square and latticed on only one side. A typical vertical at span 2 is approximately 22" square and latticed on both sides.

34. In spans with an even number of panels, counter diagonals were placed in the two center panels.

35. On October 9, 1894 the Bridge Commission ordered a change in the alignment of this span. Apparently, the original alignment encroached on the Brown property. It was ordered moved two feet to the north. This change affected the design of span 1 and caused a delay at the Berlin works. This delay was later discussed when the City attempted to hold Dean & Westbrook liable (at the rate of $25/day) for these delays. A similar change was required on span 1 on October 20 to accommodate a bend in a gas pipe. See the *Evening Patriot* (5 July 1895): 1.

36. The proportions of the concrete mix were as follows: 1 part Portland cement, 2 parts sand, 4 parts stone. It is not clear from 19th century sources whether the deck concrete was reinforced or plain.

37. The name "Bridgeport railing" would suggest a manufacturer in or near Bridgeport, Connecticut. This was a railing commonly used by Berlin Iron Bridge Company. The Bridgeport Malleable Iron Co.and the Bridgeport Forge Company (both in the Bridgeport area and in operation in 1895) may have manufactured the ornamental ironwork for this bridge. While no surviving Rhode Island Bridges have Bridgeport railings, photographs of the old Centerville, Nasonville, and Hamilton Street Bridges clearly show the same railing as that of the Court Street Bridge.

38. An interesting postscript to the matter of bridge paint is the City's demand that Dean & Westbrook clean up the unsightly paint spills on the abutment masonry. Apparently, workers had "tipped over paint pots...and marked initials on the stone." *Evening Patriot* (5 July 1895): 1

39. PARE Engineering. *Draft Section 106 Preliminary Case Report: Aesthetic Retrofit Rehabilitation of Court Street Bridge No. 959* (1995, p. 12)

## SOURCES OF INFORMATION/BIBLIOGRAPHY

**Engineering Drawings:**

Two original construction drawings and subsequent repair drawings (1938 and 1960) for the Court Street Bridge are on file at the City Engineer's Office, Woonsocket City Hall, plan room, 169 Main Street, Woonsocket.

**Historic Views:**

Approximately 90 digital images documenting the construction, setting, and later views of the Court Street Bridge are available for viewing as part of a computer-based media program at the Woonsocket Public Library. These views were culled from a much larger collection of slides assembled over the last twenty years by the Social Studies Department of Woonsocket High School. The full slide and photo collection, including many images of the Court Street Bridge, is located in the Crowley-Bacon Room at the library of the High School.

**Bibliography:**

Books:

*A Chronological History of Electrical Development.* New York: National Electrical Manufacturers Association, 1946

*Artwork of Rhode Island.* Chicago: W.H. Parish & Co., 1896

Bayles, Richard M. (Ed.). *History of Providence County.* New York: W.W. Preston & Co., 1891

Carroll, Charles. *Rhode Island: Three Centuries of Democracy.* New York: Lewis Historical Publishing Company, 1922

Darnell, Victor. *A Directory of American Bridge Building Companies 1840-1900.* Washington, D.C.: Society for Industrial Archeology, 1984

Kulik, Gary and Julia C. Bonham. *Rhode Island: An Inventory of Historic Engineering Sites.* Washington: Historic American Engineering Record, 1978

Passer, Harold C. *The Electrical Manufacturers, 1875-1900.* Cambridge: Harvard University Press, 1953

Tyrell, Henry Grattan. *History of Bridge Engineering.* Chicago: by the author, 1911

Articles:

"Bridge Celebration." *The Evening Call* (24 June 1895): 4

"Bridge Matters." *The Evening Reporter* (16 April 1895): 4

"Court St. Bridge Once Blackstone Valley Marvel." *The Woonsocket Call* (5 March 1938)

"Glances About Town." *Woonsocket Patriot and Rhode Island State Register* (4 September 1868): 2

"Many Memories Revived By Wrecking of One-Time Groton Mill, An Old Landmark." *The Woonsocket Call* (18 September 1937)

"New Plan A Bridge." *The Evening Call* (20 June 1895): 3

Peckham, S.F. "Asphaltum for a Modern Street." *The Popular Science Monthly* 58 (January 1901): 225-37

"St. John's Day." *The Providence Journal* (25 June 1895): 8

"The Old Bridge." *The Evening Call* (26 June 1895): 4

"The Plant of the Berlin Iron Bridge Company at East Berlin, Connecticut." *Engineering News* (3 October 1891): 316-8

"Woonsocket Ablaze." *Providence Sunday Journal* (23 June 1895): 7

*Woonsocket Evening Reporter* Special Edition, 24 June 1895

Unpublished material:

*Draft Section 106 Preliminary Case Report, Court Street Bridge 959.* Prepared by Pare Engineering, May 1995. On file at RI Department of Transportation

*Field Book No. 21.* Field notes on the construction of the Court Street Bridge. On file at Woonsocket City Hall, City Engineer's Office, plan room, 169 Main Street, Woonsocket

Galer, Gregory J. *The Boston Bridge Works and the Evolution of Truss Building Technology.* Undergraduate honors thesis, Brown University, 1989. A copy of this thesis is available at the Hay Library, Brown University.

Marshall, Philip C. *Finishes Analysis, Court Street Bridge, Woonsocket, RI.* March 1994. On file at RI Department of Transportation

Government Documents:

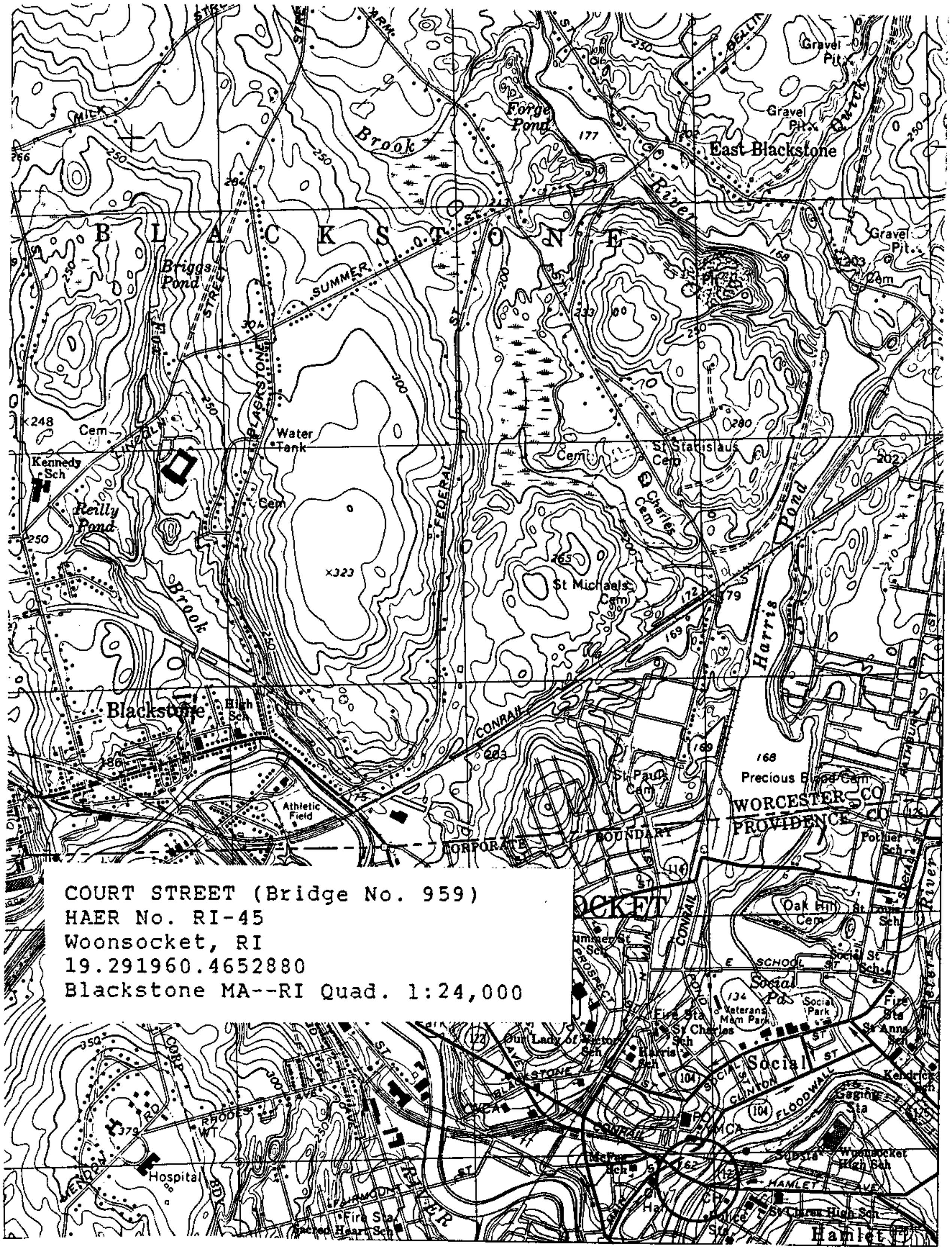
Clouette, Bruce and Roth, Matthew. *Rhode Island Historic Bridge Inventory*. Providence: RI Department of Transportation, 1988

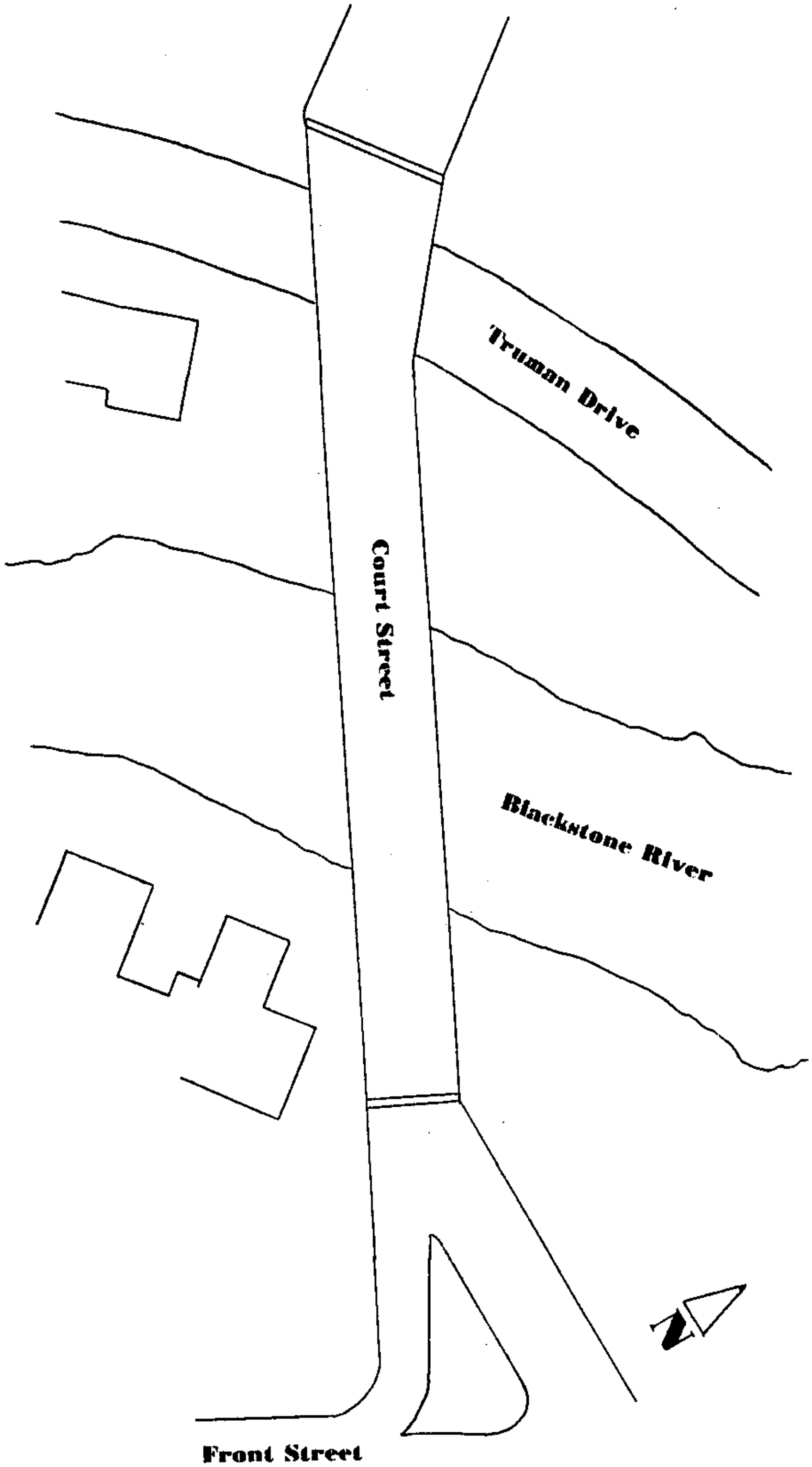
*Annual Report of the City Engineer*, City of Woonsocket (1896-1917)

Manuscript *Records of the Board of Aldermen and City Council*. City of Woonsocket (1887-1900)

Manuscript *Common Council Record*, City of Woonsocket (1889-1894)

*Statewide Historic Preservation Report (P-W-1), Woonsocket, Rhode Island*. R.I. Historical Preservation Commission: 1976


COURT STREET (Bridge No. 959)
HAER No. RI-45
Woonsocket, RI
19.291960.4652880
Blackstone MA--RI Quad. 1:24,000
B L A C K S T O N E
East Blackstone
Blackstone
Forge Pond
Briggs Pond
Reilly Pond
Harris Pond
Kennedy Sch
Water Tank
St Michaels Cem
St Charles Cem
St Stanislaus Cem
St Paul's Cem
Precious Blood Cem
WORCESTER CO
PROVIDENCE CO
Athletic Field
Hospital
Oak Hill Cem
Veterans Mem Park
Social Park
St Clares High Sch
Hamlet




SKETCH PLAN     Approximate Scale: 1" = 100'